The Builder.

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IT is much to be regretted that architects and engineers have left few records of the conduct and progress of their works. When we name Labelye's "Description of Westminster Bridge (1751):" Perronet's *Description des Projets et de la Construction des Ponts de Neuilly, de Mantes, &c.* (1782); Rondelet's *Mémoire Historique sur le Dome du Panthéon Français* (1797); Smeaton's "Narrative of the Building, and a Description of the Construction of the Eddystone Lighthouse," we have mentioned nearly all that are of any importance. The value of such records can scarcely be overrated; and every inducement should be held out for the production of such accounts of future works, records of the principles which regulated the design, the modes of construction employed, the failures, if any, that occurred, and the facts that were made evident during the progress of the undertaking.

Entertaining this opinion, we can but view with pleasure the publication, by Mr. Edwin Clark, the resident engineer during the construction of the Britannia and Conway Tubular Bridges, of a full and comprehensive account of those great achievements of modern science and skill,* and that, too, notwithstanding the previous appearance of Mr. Fairbairn's volume on the same subject, to which full justice was done in our pages some time ago.

Mr. Clark's work consists of two large octavo volumes of letter-press and tables, illustrated with wood engravings, and a folio volume containing forty-five plates: six of these are tinted lithographs by Mr. George Hawkins, and the remainder are engraved on stone by Messrs. Day and Son. Both Mr. Hawkins and Messrs. Day, we may say at starting, have executed their parts well. As regards the latter, plate 7, "The Anglesea Entrance," may be cited as a singularly good specimen of etched lithography. The tinted views are from sketches made with the camera lucida, and perpetuate the process of construction.

To give a general idea of the contents of the work, we may state briefly that section 1 contains a record by Mr. Stephenson himself of the circumstances which led to these surprising structures, the reasoning from which they emanated, and the early development of the design. Section 2 contains an account of the preliminary experiments, with practical deductions. In section 3 a general exposition of the theory of beams is given. Section 4 contains many experiments on the strength of materials as employed in construction. The elaboration of the detail is continued in section 5. Sections 6 and 7 contain a minute description of the structures themselves, the floating, and the incidents peculiar to works of such magnitude. Section 8 is devoted to the application of the general reasoning contained in preceding chapters, the calculations of strength and deflection; and section 9 gives an account of a long series of tidal observations, and closes the work.

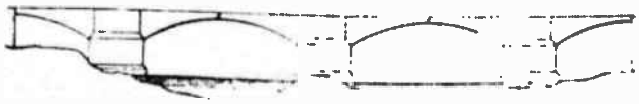
Our readers do not now require to be told that the Britannia Bridge is part of the Chester and Holyhead Railway, the connecting link between the capitals of England and Ireland; that it passes from the Anglesey coast to the Carnarvon side of the Menai Straits; that the river is at that point divided into two channels by a bed of irregular rocks, and that the total water-width from shore to shore in the line of the bridge is 1,100 feet. It may be well, however, to remind them of these points, and to say further, that any midway support was limited to a small area of the rock mentioned; the roadway was required to be 103 feet above the water, scaffolding from below was impracticable, and the navigation was under no circumstances to be interfered with. To meet these requirements, hollow beams, each 472 feet long (get a clear idea of this length in your own mind before you go any further).—hollow beams, 472 feet long, were constructed on the beach, 1,500 feet from their permanent site; were floated upon rapid tides to their destination; and, although weighing nearly 2,000 tons each, were ultimately lifted 100 feet up into their place, to bear Mr. Stephenson's name with honour to posterity.

"It will assist the judgment, in considering the magnitude of this span, to call to mind the dimensions of some of the largest existing insistent structures, premising that a suspension-bridge would be inapplicable to railway purposes.

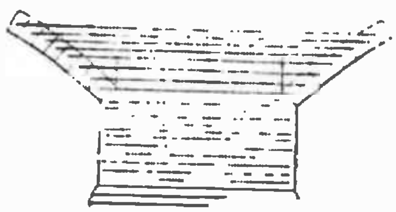
	Material.	Span of the Arch.	Rise of Centre.	Date of Completion.	Engineer.
		Ft.	Ft.		
Sunderland over the Wear	Cast Iron	236	30	1796	Wilson
Southwark Bridge	Ditto	240	24	1819	Rennie
Dee Bridge, Chester	Sandstone Arch	200	42	1832	Hartley
Pont du Carrousel, over the Seine	Cast Iron	147	15½	1836	Polonceau
London Bridge	Granite	152	29½	1831	Rennie
Maidenhead Bridge, over the Thames, on the Great Western Railway	Brick	128	24¼	1838	Brunel

It will be observed how far short all these magnificent works fall of the dimensions required, the tube for the Britannia Bridge being 472 feet long, or nearly double the largest of them."

While the problem, how to cross, was yet unsettled, Mr. Stephenson entertained the idea, amongst others, of cast iron arches, by placing equal and corresponding ribs on opposite sides of the pier, and to complete the ironwork in the form shown by the following figure.

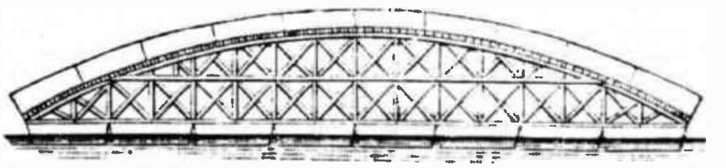


The erection of the arch was to be proceeded with by placing equal and corresponding voussoirs on opposite sides of the pier at the same time, tying them together by horizontal tie-bolts, as shown below.



This system, it is confidently believed, may be successfully carried out to a far greater extent than would have been required in the case of the Britannia Bridge.

The peculiarity of the site of Conway Bridge pointed out the necessity of some other method being devised for the erection of the arch, and led to the idea of building the arch complete on centering supported entirely upon, and framed into, a series of pontoons kept afloat during the whole time of construction. This arrangement, which is shown in the following sketch, appeared upon the whole by far the most feasible that had been suggested, and well adapted for placing the arch into its permanent position.



"The rise and fall of the tide was such as to admit of its being brought immediately above the springings and lowered into its place by the falling tide, or by admitting water into the pontoons at the top of the tide, before the velocity of the ebb stream had increased so as to interfere with the accurate adjustment of the descending mass."

We must not attempt to follow the work through all its chapters, but will dip into it for such passages as, while they give an idea of its execution, will afford information to our readers. We will first take some experiments made (with actual weight) on the crushing of the limestone, sandstone, and brick employed in the construction.

"The bricks were built into cubes in cement, so that six bricks were used in each experiment, breaking joint. The bricks were not of a hard description, being manufactured on the spot.

BRICKWORK. Lbs. per Sq. Inch.

No. 1. 9-inch cube of cemented brickwork (Newell and Co.), No. 1 (or best quality), weighing 54 lbs., set between deal boards.

Crushed with 19 tons 18 cwt. 2 qrs. 22 lbs. .. .. = 551·1

No. 2. 9-inch brickwork, No. 1, weighing 53 lbs., set in cement.

Crushed with 22 tons 5 cwt. 0 qrs. 17 lbs. .. .. = 612·7

No. 3. 9-inch brickwork No. 3, weighing 52 lbs., set in cement.

Crushed with 15 tons 8 cwt. 2 qrs. 8 lbs. .. .. = [illegible]

No. 4. 9½-inch brickwork, No. 4, weighing 55½ lbs., set in cement.

Crushed with 21 tons 14 cwt. 1 qr. 17 lbs. .. .. = 56[illegible]·5

No. 6. 9-inch brickwork No. 4, weighing 54½ lbs., set between boards.

* The Britannia and Conway Tubular Bridges. With General Inquiries on Beams, and on the Properties of Materials used in Construction. By Edwin Clark, Resident Engineer. Published with the sanction, and under the supervision of Robert Stephenson. In Two Volumes, with Plates, in folio. London, published for the Author by Day and Son, Lincoln's-Inn Fields; and John Weale.